PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-097308

(43)Date of publication of application : 03.04.2003

(51)Int.Cl. F02D 21/08
F02D 9/02
F02D 41/04
F02D 43/00
F02D 45/00
F02M 25/07

(21)Application number : 2001-286970

(22)Date of filing : 20.09.2001

(71)Applicant : NISSAN MOTOR CO LTD

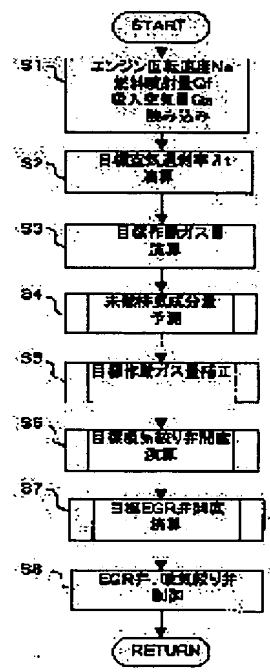
(72)Inventor : MIURA MANABU

(54) CONTROL DEVICE FOR INTERNAL COMBUSTION ENGINE

(57)Abstract:

PROBLEM TO BE SOLVED: To control an intake throttle valve and an EGR valve while ensuring combustion stability.

SOLUTION: A target air excess rate λt depending on an engine operating condition is calculated, and a target working medium amount is calculated based on the calculated target air excess rate λt (S1 to S3). An unburned exhaust component amount is predicted (S4), and when the unburned exhaust component amount exceeds a predetermined value, the calculated target working medium amount is corrected to be reduced (S5). Then, the intake throttle valve and the EGR valve are controlled so as to be the target working medium amount after correction (S6 to S8).



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

CLAIMS

[Claim(s)]
[Claim 1] The inhalation air content which is installed in an engine's inhalation-of-air path, and is inhaled by the engine A controllable inhalation-of-air throttle valve, The amount of EGR(s) which is installed in the EGR path which opens the downstream inhalation-of-air path and flueway of this inhalation-of-air throttle valve for free passage, and is inhaled by the engine A controllable EGR valve, The control unit of the internal combustion engine characterized by having an amount setting-out means of target working medium to set up the amount of target working medium of a combustion chamber based on an engine's operational status, and the amount control means of working medium which controls said inhalation-of-air throttle valve and an EGR valve so that an engine's amount of working medium turns into said amount of target working medium.
[Claim 2] Said amount control means of working medium is the control unit of the internal combustion engine according to claim 1 which has an amount setting-out means of target EGR(s) to set up the amount of target EGR(s) based on a target-intake-air-flow setting-out means to set up target intake air flow based on an engine's operational status, and said amount of target working medium and target intake air flow, and is characterized by controlling said inhalation-of-air throttle valve and an EGR valve based on the target intake air flow and the amount of target EGR(s) which were set up.
[Claim 3] It is the control unit of the internal combustion engine according to claim 1 or 2 which has a flame-failure judging means to judge a flame failure, and the amount amendment means of working medium which carries out reduction amendment of said amount of target working medium when a flame failure is judged, and is characterized by said amount control means of working medium controlling said inhalation-of-air throttle valve and an EGR valve so that an engine's amount of working medium turns into said amount of target working medium by which reduction amendment was carried out.
[Claim 4] Said flame-failure judging means is the control unit of the internal combustion engine according to claim 3 characterized by judging with a flame failure when the amount of unburnt exhaust air components which detected or presumed, and detected or presumed the amount of unburnt exhaust air components discharged by the engine exceeds the specified quantity.
[Claim 5] The control unit of the internal combustion engine according to claim 4 characterized by presuming said amount of unburnt exhaust air components based on at least one of an inhalation air content, fuel oil consumption, and engine circulating water temperatures.
[Claim 6] The control unit of the internal combustion engine of any one publication of claim 1 to claim 5 characterized by making the amount of working medium of a combustion chamber increase with excess-air-factor regularity by enlarging the opening of said inhalation-of-air throttle valve and an EGR valve.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the control technique of an inhalation-of-air throttle valve and an EGR valve about an internal combustion engine's control unit.
[0002]
[Description of the Prior Art] There are some which were indicated by JP,10-68315,A as a technique which controls simultaneously an engine's inhalation-of-air throttle valve and EGR valve.
[0003]
[Problem(s) to be Solved by the Invention] By the way, the amount of working medium of a combustion chamber (total of an inhalation air content and the amount of EGR(s)) influences the ignitionability of a fuel. When compression edge temperature becomes high, the ignitionability of a fuel improves (continuous line) and the amount of working medium decreases so that there are many amounts of working medium of a combustion chamber in the case of the same excess air factor as shown in ******** and drawing 14 , it has the inclination for compression edge temperature to fall and for ignitionability to get worse (broken line).
[0004] Therefore, in order to secure good ignitionability, it is necessary to make working medium of a combustion chamber into a proper amount. However, since the above-mentioned conventional thing is not taking into consideration change of the amount of working medium of the combustion chamber produced by opening modification of an inhalation-of-air throttle valve and an EGR valve, the amount of working medium may become less than the amount according to operational status, and ignitionability may get worse.
[0005] This invention is made in view of the above problems, and it aims at offering the control unit of the internal combustion engine which can control an inhalation-of-air throttle valve and an EGR valve, securing combustion stability by taking into consideration change of the amount of working medium.
[0006]
[Means for Solving the Problem] The inhalation air content which invention concerning claim 1 is installed in an engine's inhalation-of-air path, and is inhaled by the engine Therefore, a controllable inhalation-of-air throttle valve, The amount of EGR(s) which is installed in the EGR path which opens the downstream inhalation-of-air path and flueway of this inhalation-of-air throttle valve for free passage, and is inhaled by the engine A controllable EGR valve, It is characterized by having an amount setting-out means of target working medium to set up the amount of target working medium of a combustion chamber based on an engine's operational status, and the amount control means of working medium which controls said inhalation-of-air throttle valve and an EGR valve so that an engine's amount of working medium turns into said amount of target working medium.
[0007] Said amount control means of working medium is equipped with a target-intake-air-flow setting-out means to set up target intake air flow based on an engine's operational status, and an amount setting-out means of target EGR(s) to set up the amount of target EGR(s) based on said amount of target working medium and target intake air flow, and invention concerning claim 2 is characterized by controlling said inhalation-of-air throttle valve and an EGR valve based on the target intake air flow and the amount of target EGR(s) which were set up.
[0008] Invention concerning claim 3 is equipped with a flame-failure judging means to judge a flame failure, and the amount amendment means of working medium which carries out reduction amendment of said amount of target working medium when a flame failure is judged, and said amount control means of working medium is characterized by controlling said inhalation-of-air throttle valve and an EGR valve so that an engine's amount of working medium turns into said amount of target working medium by which

reduction amendment was carried out.
[0009] It is characterized by invention concerning claim 4 judging said flame-failure judging means to be a flame failure, when the amount of unburnt exhaust air components which detected or presumed, and detected or presumed the amount of unburnt exhaust air components discharged by the engine exceeds the specified quantity. Invention concerning claim 5 is characterized by presuming said amount of unburnt exhaust air components based on at least one of an inhalation air content, fuel oil consumption, and engine circulating water temperatures.
[0010] Invention concerning claim 6 is characterized by making the amount of working medium increase with excess-air-factor regularity by enlarging the opening of said inhalation-of-air throttle valve and an EGR valve.
[0011]
[Effect of the Invention] Since an inhalation-of-air throttle valve and an EGR valve are controlled to set up the amount of target working medium of a combustion chamber according to an engine's operational status, and to become this amount of target working medium according to invention concerning claim 1, a proper quantity of working medium can be secured and the ignitionability of a fuel can be maintained good.
[0012] In addition, if said amount of target working medium is increased and it sets up, compression edge temperature can be raised to the bottom of the same excess air factor, and the ignitionability of a fuel can be improved. According to invention concerning claim 2, the amount of target EGR(s) is set up based on the target intake air flow set up according to an engine's operational status, and said amount of target working medium. Since an inhalation-of-air throttle valve and an EGR valve are controlled based on the target intake air flow and the amount of target EGR(s) which were set up While securing the amount of working medium and raising the ignitionability of a fuel, it can also be prevented that avoid that the ratio of the amount of inert gas (EGR) increases too much among the amounts of working medium, and the rate of combustion falls.
[0013] Thereby, an inhalation-of-air throttle valve and GR valve are controllable, securing combustion stability (ignitionability and rate of combustion) good. Therefore, even if it is the case where set up an excess air factor small at the time of the cold machines immediately after start up etc., carry out temperature up of the exhaust-gas temperature (making it fall), and an exhaust air clarification catalyst is activated, an inhalation-of-air throttle valve and an EGR valve can be controlled, without causing aggravation of combustion instability or exhaust air emission.
[0014] Since according to invention concerning claim 3 reduction amendment of said whole amount of target working medium is carried out when a flame failure is judged According to invention concerning claim 4 which can prevent a sharp reduction of the amount of working medium, and can maintain ignitionability good, preventing the lowering of the high rate of combustion of a contribution to a flame failure, and raising flame-failure-proof nature Since it judges with a flame failure when the amount of unburnt exhaust air components detected or presumed, and a flame failure and correlation detected or presumed the strong amount of unburnt exhaust air components to be exceeds the predetermined value set up beforehand, a flame-failure judging is easy.
[0015] According to invention concerning claim 5, since the amount of unburnt exhaust air components, an inhalation air content and the amount of unburnt exhaust air components, fuel injection timing and the amount of unburnt exhaust air components, and a circulating water temperature have a respectively fixed relation, the amount of unburnt exhaust air components can be easily presumed by detecting or measuring at least one of an inhalation air content, fuel injection timing, and circulating water temperatures.
[0016] According to invention concerning claim 6, the amount of working medium can be made to increase with excess-air-factor regularity by enlarging the opening of both an inhalation-of-air throttle valve and an EGR valve. That is, it is impossible for an excess air factor to increase and to make the amount of working medium increase with excess-air-factor regularity only by enlarging the opening of only an inhalation-of-air throttle valve, and only by enlarging only an EGR valve, since negative pressure decreases by the increment in the amount of EGR(s) and the inhalation air content relatively inhaled by the combustion chamber decreases, it is impossible to make the amount of working medium increase with excess-air-factor regularity.
[0017] Therefore, the amount of working medium can be made to increase with excess-air-factor regularity by enlarging the opening of an inhalation-of-air throttle valve so that a part for the inhalation air content which decreases by enlarging the opening of an EGR valve may be compensated.
[0018]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on

drawing. Drawing 1 is the system chart of a diesel power plant with a supercharger. As shown in drawing, the common rail fuel-injection system which uses as a component a common rail 2, a fuel injection valve 3, and the fuel pump that is not illustrated is prepared in the engine 1, and a high-pressure fuel is supplied to an engine 1.
[0019] It connects with the inhalation-of-air path 5, and compressor 4a of a supercharger 4 is driven and supplies a compressed air to an engine 1. It connects with the flueway 6, and turbine 4b of a supercharger 4 rotates with the exhaust air from an engine 1, and drives said compressor 4a. In addition, in this operation gestalt, the high supercharge effectiveness can be acquired by the large operating range by using the thing of a variable-capacity mold as a supercharger 4, extracting the adjustable nozzle prepared in the turbine 4b side in the low-speed area, raising a turbine efficiency, opening said adjustable nozzle in a high-speed region, and making turbine capacity expand.
[0020] The air flow meter 15 arranged in the upstream of compressor 4a of said supercharger 4 and the inhalation-of-air throttle valve 7 are formed in the inhalation-of-air path 5. Using a step motor, the inhalation-of-air throttle valve 7 is the thing of the electronics control type in which opening modification is possible, and controls the inhalation air content inhaled by the engine 1 according to the opening.
[0021] The exhaust emission control device 10 arranged in the downstream of the EGR path 8 which branches from between an engine 1 and turbine 4b of a supercharger, and is connected to the inhalation-of-air path 5, the EGR valve 9 infixed in this EGR path 8, and turbine 4b of said supercharger 4 is formed in the flueway 6. It is the thing of the electronics control type using a step motor, and said EGR valve 9 controls the amount of EGR(s) of the exhaust air which flows back to an inspired air flow path according to the opening, i.e., the amount inhaled by the engine 1.
[0022] Said exhaust emission control device 10 purifies the exhaust air discharged by the supported catalyst from an engine 1 by oxidation / reduction reaction. A control unit 20 performs opening control of said inhalation-of-air throttle valve 7 and the EGR valve 9 while it sets up fuel oil consumption Qf and fuel injection timing IT based on the detecting signal from the various sensors inputted and controls actuation of said fuel injection valve 3.
[0023] In addition, as said various sensors, there is air flow meter 15 grade which detects a sensor 14 and the inhalation air content Qa whenever [catalyst temperature / which detects whenever / catalyst temperature / of the engine revolution sensor 11 which detects an engine speed Ne, the accelerator opening sensor 12 which detects an accelerator opening, the coolant temperature sensor 13 which detects the engine-cooling-water temperature Tw, and said exhaust emission control device 10].
[0024] By the way, since said exhaust emission control device 10 cannot purify exhaust air, without being activated unless the catalyst (exhaust air clarification catalyst) becomes beyond predetermined temperature, it is necessary to carry out temperature up of whenever [catalyst temperature] at an early stage at the time of the cold machines immediately after engine start up etc. So, with this operation gestalt, immediately after engine start up, the temperature up of the temperature of a combustion chamber, as a result an exhaust-gas temperature is brought forward, and early activation of whenever [catalyst temperature] is in drawing by what (it is made to fall) an excess air factor lambda (namely, new air volume of the low temperature inhaled in a cylinder) is set up for smaller than the excess air factor set up at the time of the usual warming-up.
[0025] Here, there is an approach to which the amount of EGR(s) is made to increase from the time of the usual warming-up by controlling the approach of decreasing the inhalation air content Qa, and the EGR valve 9 by controlling the inhalation-of-air throttle valve 7 as an approach (for it to be made to fall) of setting up an excess air factor lambda small. When an excess air factor lambda is made small only by the inhalation-of-air throttle valve 7, the amount of working medium of a combustion chamber (the amount of inhalation air content Qa+EGR) decreases rather than the amount according to operational status, and since compression edge temperature falls, it has the problem that the ignitionability of a fuel will get worse.
[0026] On the other hand, although compression edge temperature also rises and ignitionability can be maintained since the amount of EGR(s) in which temperature rose by combustion increases if an excess air factor lambda is made small only by the EGR valve 9, the rate of the amount of EGR(s) which is inert gas increases rather than the amount according to operational status, and it has the problem that the rate of combustion will fall. Therefore, in order to carry out temperature up of the exhaust-gas temperature, maintaining combustion stability (effectively), while securing the amount of the working medium of a combustion chamber, it is necessary to make it comparatively (EGR rate) not become large too much as for the amount of EGR(s) in this working medium.
[0027] For this reason, although an exhaust-gas temperature is raised with this operation gestalt by reducing an excess air factor lambda immediately after engine start up, in order to compensate aggravation of the

ignitionability by reduction (namely, reduction of the amount of working medium) of the inhalation air content Qa accompanying decline in an excess air factor lambda, the amount of EGR(s) is made to increase and the amount of working medium is secured proper. He is trying to set up the amount of working medium (the amount of target working medium) which made the inhalation air content Qa and the amount of EGR(s) balance in that case, so that lowering of the rate of combustion by the increment in the amount of EGR(s) may be controlled.

[0028] Hereafter, control of the inhalation-of-air throttle valve 7 immediately after engine start up and the EGR valve 9 is explained. Drawing 2 is a flow chart which shows the Maine control routine. Step 1 (it is described as S1 by a diagram.) In it being below the same, engine-speed Ne, fuel oil consumption Qf, and the inhalation air content Qa are read.

[0029] Here, an engine speed Ne and the inhalation air content Qa are detected by the 11 air flow meter engine-speed sensor 15, respectively, and fuel oil consumption Qf is set up according to operational status. At step 2, target excess-air-factor lambdat is computed with reference to a map as shown in drawing 3 based on the engine speed Ne and fuel oil consumption Qf which were read.

[0030] Although said target excess-air-factor lambdat sets up the optimal value according to an engine operation condition at the time of the usual warming-up, here In carrying out temperature up of the exhaust-gas temperature like [at the time of the cold machine immediately after engine start up], it sets up a value smaller than the value set up in the same operational status as this target excess-air-factor lambdat at the time of the usual warming-up (consequently, an excess air factor lambda is made to fall at the time of a cold machine).

[0031] The amount of target working medium is computed by searching a table as shown in drawing 4 with step 3 based on computed target excess-air-factor lambdat. This amount of target working medium computes the amount of working medium used as the EGR rate which can secure combustion stability (ignitionability and rate of combustion) good at the time of target excess-air-factor lambdat.

[0032] Here, the table for the amount calculation of target working medium (drawing 4) is explained with reference to drawing 5 . As mentioned above, when reducing an excess air factor lambda by controlling only the EGR valve 9 (namely, the amount of EGR(s)), since the amount of EGR(s) is made to increase, although an inhalation air content decreases, there is little change of the amount of working medium (drawing 5 : continuous line).

[0033] However, since a limitation is in the excess air factor (it can be made to fall) lambda which can be set up in control of only the EGR valve 9, it is necessary to also use together control of the inhalation-of-air throttle valve 7 to reduce an excess air factor lambda beyond this limitation. That is, it is necessary to reduce an excess air factor lambda by extracting the inhalation-of-air throttle valve 7, considering the EGR valve 9 as full admission (drawing 5 : broken line). In this case, if an excess air factor lambda is mainly reduced, since the rate of EGR which is inert gas will increase control of the EGR valve 9, the rate of combustion becomes slow.

[0034] If an excess air factor lambda is reduced by controlling only the inhalation-of-air throttle valve 7 (namely, inhalation air content Qa), in order that the amount of working medium may decrease on the other hand, compression edge temperature falls and the ignitionability of a fuel gets worse (drawing 5 : alternate long and short dash line). Thus, since it has the inclination for the rate of combustion to become slow when the inclination for ignitionability to get worse is shown when inhalation-of-air drawing is performed, in order to reduce an excess air factor lambda, and EGR is performed, In reducing an excess air factor lambda especially at the time of low temperature (that is, temperature up of the exhaust-gas temperature is carried out) the amount of EGR(s) (ratio) occupied to the amount of working medium, and working medium by making opening setting out of the inhalation-of-air throttle valve 7 and the EGR valve 9 balance -- proper -- securing -- combustion -- it is necessary to avoid an unstable condition

[0035] The table of drawing 4 is set up in consideration of this point, and computes the optimal (the EGR rate was taken into consideration) amount of target working medium according to an excess air factor lambda. It returns to the flow chart of drawing 2 , and the amount of unburnt exhaust air components is predicted at step 4. At step 5, reduction amendment of said amount of target working medium is performed based on the predicted amount of unburnt exhaust air components.

[0036] At step 6, a target inhalation-of-air throttle valve opening is computed based on the amount of target working medium after amendment. At step 7, whenever [target EGR valve-opening] is computed based on the amount of target working medium after amendment. At step 8, opening control of the inhalation-of-air throttle valve 7 and the EGR valve 9 is performed.

[0037] The opening of the inhalation-of-air throttle valve 7 is controlled to specifically become the target

inhalation-of-air throttle valve opening computed at step 6, and the opening of the EGR valve 9 is controlled to become whenever [target EGR valve-opening / which was computed at step 7]. It becomes possible to control the inhalation-of-air throttle valve 7 and the EGR valve 9, securing combustion stability, if it does in this way.
[0038] In addition, although the amount of target working medium is used as a value which represents with the above-mentioned flow chart the capacity which flows in a cylinder, it replaces with this target working medium, and you may make it use target volume effectiveness. In this case, based on the target volume effectiveness which computed and computed target volume effectiveness according to the engine operation condition, the inhalation-of-air throttle valve 7 and the EGR valve 9 will be controlled.
[0039] Next, the control performed at each step of said Maine control routine (drawing 2) is explained. Drawing 6 is a flow chart which shows prediction data processing of the amount of unburnt exhaust air components performed at step 4 of said Maine control routine (drawing 2). At step 11, the inhalation air content Qa, fuel oil consumption Qf, fuel injection timing IT, and the engine-cooling-water temperature Tw are read.
[0040] At step 12, the amount of unburnt exhaust air components is predicted. Since it turns out that it has a relation as shown in drawing 7 - drawing 9 R> 9, respectively, specifically, the amount of unburnt exhaust air components, and an excess air factor lambda (** inhalation air content Qa / fuel oil consumption Qf), fuel injection timing IT (ATDC) and a circulating water temperature Tw predict the amount of unburnt exhaust air components by performing predetermined data processing based on these tables.
[0041] Drawing 10 is a flow chart which shows the reduction amendment processing of the amount of target working medium performed at step 5 of said Maine control routine (drawing 2 R> 2). At step 21, the unburnt exhaust air component forecast computed at step 4 of drawing 2 is detected. Step 22 compares the amount forecast of unburnt exhaust air components and predetermined value which were detected.
[0042] When it results in a flame failure (or just before a flame failure), this predetermined value is set up as a value which shows the amount of unburnt components discharged from an engine, and is beforehand calculated by experiment etc. When said forecast is larger than a predetermined value, it judges with a flame failure, and progresses to step 23, and reduction amendment of the amount of target working medium computed at step 3 of drawing 2 is carried out.
[0043] That is, since it is necessary to improve lowering of the rate of combustion of a combustion chamber when a flame failure is judged, it is necessary to decrease the amount of EGR(s). However, when only the amount of EGR(s) is decreased, shortly, the amount of working medium will decrease greatly and aggravation of the ignitionability of a fuel will be caused. Therefore, by carrying out reduction (as a whole) amendment of said amount of target working medium as which combustion stability was considered, suppressing aggravation of ignitionability to the minimum, the amount of EGR(s) which is inert gas is reduced, and lowering of the rate of combustion is improved.
[0044] Thereby, flame-failure-proof nature can be raised. When said forecast is below a predetermined value, amendment of the amount of target working medium is not performed, but this control is ended as it is. In addition, although it may be made to carry out specified quantity reduction of the amount of target working medium as the approach of reduction amendment of said amount of target working medium uniformly when said forecast is larger than a predetermined value, it may be made to make [many] the amount reduced, so that the difference of said forecast and predetermined value becomes large. If it does in this way, it will become controllable corresponding to flame-failure level.
[0045] Drawing 11 is a flow chart which shows calculation of target inhalation-of-air throttle valve 7 opening performed at step 6 and step 7 of said Maine control routine (drawing 2 R> 2), and EGR valve 9 opening. At step 31, the amount of target working medium (amendment back) computed at the fuel oil consumption Qf set up according to target excess-air-factor lambdat computed at step 2 of drawing 2 and operational status and step 5 of drawing 2 is read.
[0046] Target intake air flow Qt is computed at step 32. As shown in a bottom type, specifically, target intake air flow Qt is computed by carrying out the multiplication of theoretical air fuel ratio (14.6) and the fuel oil consumption Qf to target excess-air-factor lambdat. The amount of target EGR(s) is computed at the target-intake-air-flow Qt= target excess-air-factor lambdatx14.6x fuel-oil-consumption Qf step 33.
[0047] As shown in a bottom type, specifically, the amount of target EGR(s) is computed by subtracting said target intake air flow Qt from the amount of target working medium (amendment back). The amount of target EGR(s) = a target inhalation-of-air throttle valve opening is computed by searching a table as shown in drawing 1212 with the amount of target working medium-target-intake-air-flow Qt step 34 based on the target intake air flow and the amount of target EGR(s) which were computed.

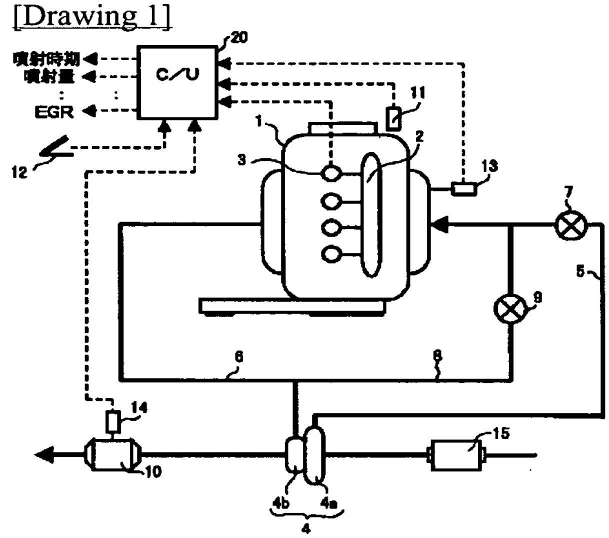
[0048] Whenever'[target EGR valve-opening] is computed by searching a table as shown in drawing 13 with step 35 based on the target intake air flow and the amount of target EGR(s) which were computed. As explained above, in the time of the low temperature immediately after start up, in **** an exhaust-gas temperature by setting up an excess air factor smaller than the time of the usual warming-up in the same operational status as target excess-air-factor lambdat with ** Early activation of an exhaust air clarification catalyst can be attained securing combustion stability, since opening setting out of the inhalation-of-air throttle valve 7 and the EGR valve 9 is performed in consideration of the balance of the inhalation air content Qa and the amount of EGR(s), securing the amount of working medium proper.
[0049] in addition, without setting up the amount of target working medium, as mentioned above, after activation termination of an exhaust air clarification catalyst sets up target intake air flow Qt and a target EGR rate based on an engine operation condition, and you may make it control the inhalation-of-air throttle valve 7 and the EGR valve 9, respectively (namely, -- irrespective of the amount of target working medium) Moreover, although the inhalation-of-air throttle valve 7 and the EGR valve 9 are controlled by the above-mentioned flow chart to become the amount of target working medium with which the inhalation air content Qa and the amount of EGR(s) balanced under target excess-air-factor lambdat, more amounts of working medium of a combustion chamber can also be set up, seting an excess air factor lambda constant.
[0050] in this case, the inhalation-of-air throttle valve 7 set up based on the map shown in drawing 4 and the EGR valve 9 -- what is necessary is just to control to each opening in the direction which opens further the both sides of the inhalation-of-air throttle valve 7 and an EGR valve

---

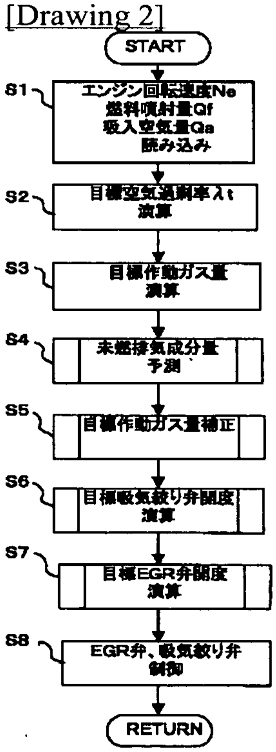
[Translation done.]

DRAWINGS

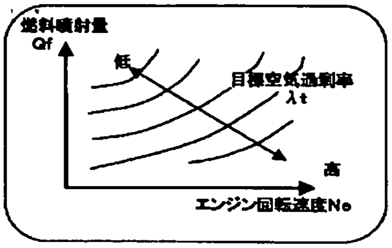
[Drawing 1]



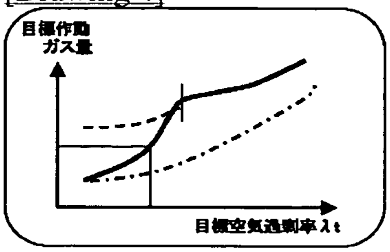
[Drawing 2]



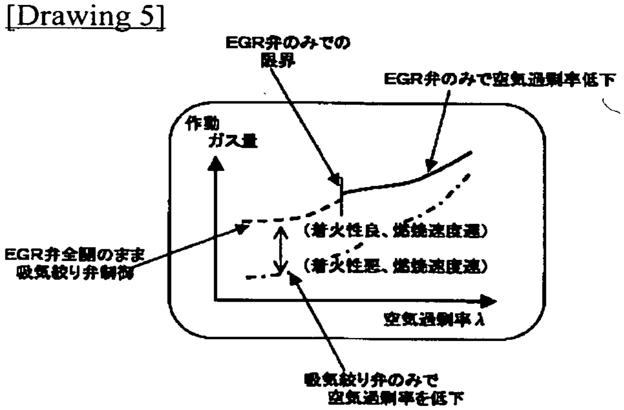
[Drawing 3]



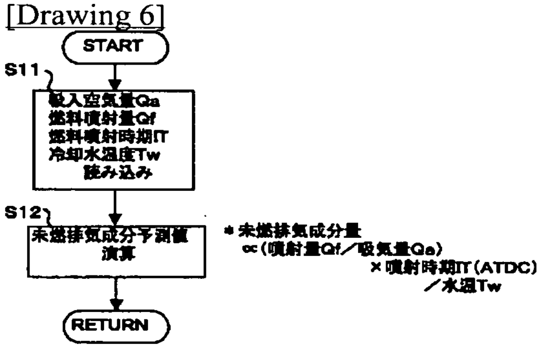
[Drawing 4]



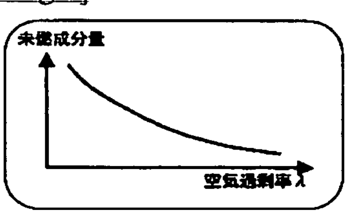
[Drawing 5]



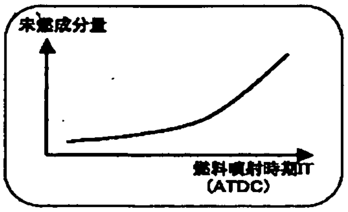
[Drawing 6]



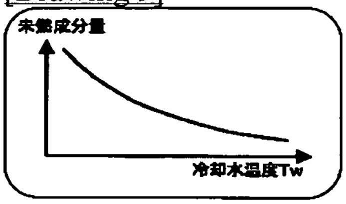
[Drawing 7]



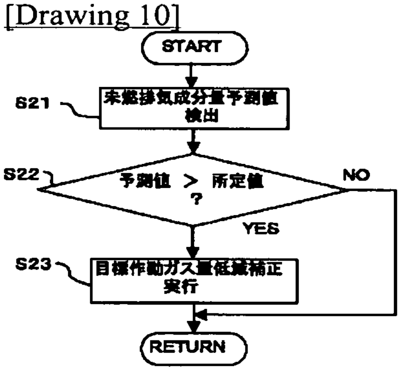
[Drawing 8]



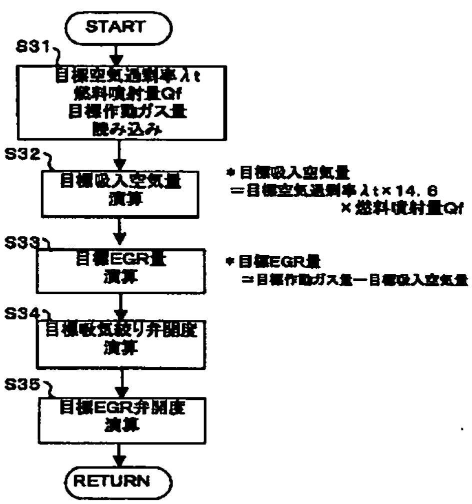
[Drawing 9]



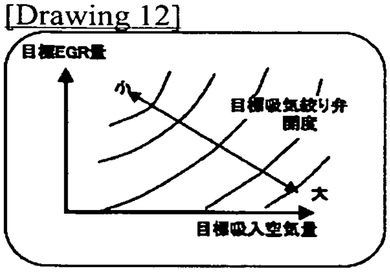
[Drawing 10]



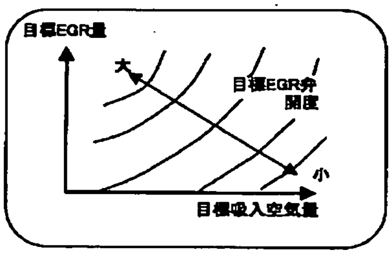
[Drawing 11]



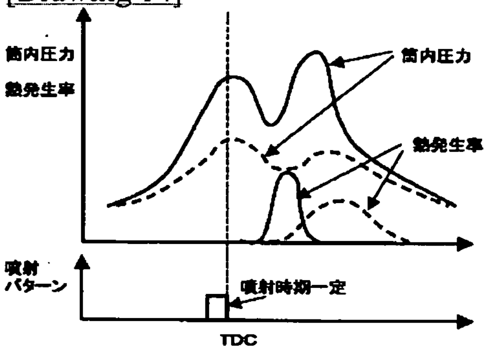
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号
特開2003－97308
（P2003－97308A）
(43)公開日　平成15年4月3日(2003.4.3)

(51)Int.Cl.⁷	識別記号	ＦＩ	テーマコード゛(参考)
Ｆ０２Ｄ　21/08	３０１	Ｆ０２Ｄ　21/08　３０１Ａ	３Ｇ０６２
9/02		9/02　Ｓ	３Ｇ０６５
41/04	３６０	41/04　３６０Ｃ	３Ｇ０８４
43/00	３０１	43/00　３０１Ｋ	３Ｇ０９２
		３０１Ｎ	３Ｇ３０１

審査請求　未請求　請求項の数６　ＯＬ　（全　８　頁）　最終頁に続く

(21)出願番号　特願2001－286970(P2001－286970)

(22)出願日　平成13年9月20日(2001.9.20)

(71)出願人　000003997
日産自動車株式会社
神奈川県横浜市神奈川区宝町２番地

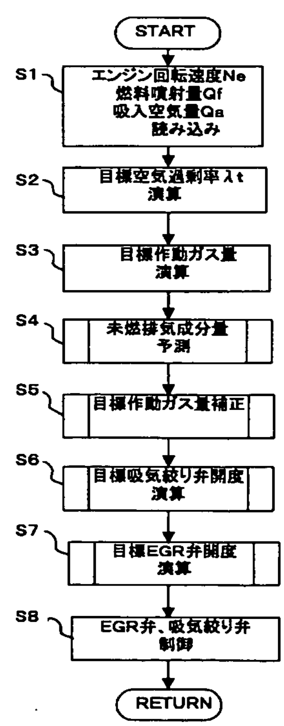
(72)発明者　三浦　学
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内

(74)代理人　100078330
弁理士　笹島　富二雄

最終頁に続く

(54)【発明の名称】　内燃機関の制御装置

(57)【要約】
【課題】燃焼安定性を確保しつつ、吸気絞り弁及びＥＧＲ弁を制御する。
【解決手段】機関の運転状態に応じた目標空気過剰率λｔを算出し、算出した目標空気過剰率λｔに基づき目標作動ガス量を算出する（Ｓ１～Ｓ３）。未燃排気成分量を予測して（Ｓ４）、未燃排気成分量が所定値を超える場合は、算出した目標作動ガス量を低減補正する（Ｓ５）。そして、補正後の目標作動ガス量となるように吸気絞り弁及びＥＧＲ弁を制御する（Ｓ６～Ｓ８）。



【特許請求の範囲】

【請求項１】機関の吸気通路に設置され、機関に吸入される吸入空気量を制御可能な吸気絞り弁と、

該吸気絞り弁の下流側吸気通路と排気通路とを連通するＥＧＲ通路に設置され、機関に吸入されるＥＧＲ量を制御可能なＥＧＲ弁と、

機関の運転状態に基づいて燃焼室内の目標作動ガス量を設定する目標作動ガス量設定手段と、

機関の作動ガス量が、前記目標作動ガス量となるように前記吸気絞り弁及びＥＧＲ弁を制御する作動ガス量制御手段と、

を備えることを特徴とする内燃機関の制御装置。

【請求項２】前記作動ガス量制御手段は、

機関の運転状態に基づいて目標吸入空気量を設定する目標吸入空気量設定手段と、

前記目標作動ガス量と目標吸入空気量とに基づいて目標ＥＧＲ量を設定する目標ＥＧＲ量設定手段と、を備え、

設定した目標吸入空気量と目標ＥＧＲ量に基づいて前記吸気絞り弁及びＥＧＲ弁を制御することを特徴とする請求項１記載の内燃機関の制御装置。

【請求項３】失火を判定する失火判定手段と、

失火が判定されたときに前記目標作動ガス量を低減補正する作動ガス量補正手段と、を備え、

前記作動ガス量制御手段は、機関の作動ガス量が前記低減補正された目標作動ガス量となるように前記吸気絞り弁及びＥＧＲ弁を制御することを特徴とする請求項１又は請求項２記載の内燃機関の制御装置。

【請求項４】前記失火判定手段は、

機関から排出される未燃排気成分量を検出又は推定し、

検出又は推定した未燃排気成分量が所定量を超えたときに失火と判定することを特徴とする請求項３記載の内燃機関の制御装置。

【請求項５】前記未燃排気成分量を、吸入空気量、燃料噴射量及び機関冷却水温度のうち少なくとも１つに基づいて推定することを特徴とする請求項４記載の内燃機関の制御装置。

【請求項６】前記吸気絞り弁及びＥＧＲ弁の開度を大きくすることにより、空気過剰率一定のまま燃焼室内の作動ガス量を増加させることを特徴とする請求項１から請求項５のいずれか１つに記載の内燃機関の制御装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、内燃機関の制御装置に関し、特に、吸気絞り弁とＥＧＲ弁の制御技術に関する。

【０００２】

【従来の技術】機関の吸気絞り弁とＥＧＲ弁とを同時に制御する技術として、例えば、特開平１０－６８３１５号公報に開示されたものがある。

【０００３】

【発明が解決しようとする課題】ところで、燃焼室内の作動ガス量（吸入空気量とＥＧＲ量の総和）は燃料の着火性に影響する。ずなわち、図１４に示すように、同一の空気過剰率の場合においては、燃焼室内の作動ガス量が多いほど圧縮端温度が高くなり燃料の着火性が向上し（実線）、作動ガス量が少なくなると圧縮端温度が低下して着火性が悪化する（破線）という傾向を有する。

【０００４】従って、良好な着火性を確保するためには、燃焼室内の作動ガスを適正な量にする必要がある。しかしながら、上記従来のものは、吸気絞り弁とＥＧＲ弁の開度変更により生じる燃焼室内の作動ガス量の変化を考慮していないため、作動ガス量が運転状態に応じた量よりも少なくなってしまい、着火性が悪化する場合がある。

【０００５】本発明は、上記のような問題を鑑みなされたものであり、作動ガス量の変化を考慮することにより燃焼安定性を確保しつつ、吸気絞り弁及びＥＧＲ弁を制御できる内燃機関の制御装置を提供することを目的とする。

【０００６】

【課題を解決するための手段】そのため、請求項１に係る発明は、機関の吸気通路に設置され、機関に吸入される吸入空気量を制御可能な吸気絞り弁と、該吸気絞り弁の下流側吸気通路と排気通路とを連通するＥＧＲ通路に設置され、機関に吸入されるＥＧＲ量を制御可能なＥＧＲ弁と、機関の運転状態に基づいて燃焼室内の目標作動ガス量を設定する目標作動ガス量設定手段と、機関の作動ガス量が、前記目標作動ガス量となるように前記吸気絞り弁及びＥＧＲ弁を制御する作動ガス量制御手段と、を備えることを特徴とする。

【０００７】請求項２に係る発明は、前記作動ガス量制御手段は、機関の運転状態に基づいて目標吸入空気量を設定する目標吸入空気量設定手段と、前記目標作動ガス量と目標吸入空気量に基づいて目標ＥＧＲ量を設定する目標ＥＧＲ量設定手段と、を備え、設定した目標吸入空気量と目標ＥＧＲ量とに基づいて前記吸気絞り弁及びＥＧＲ弁を制御することを特徴とする。

【０００８】請求項３に係る発明は、失火を判定する失火判定手段と、失火が判定されたときに前記目標作動ガス量を低減補正する作動ガス量補正手段と、を備え、前記作動ガス量制御手段は、機関の作動ガス量が前記低減補正された目標作動ガス量となるように前記吸気絞り弁及びＥＧＲ弁を制御することを特徴とする。

【０００９】請求項４に係る発明は、前記失火判定手段は、機関から排出される未燃排気成分量を検出又は推定し、検出又は推定した未燃排気成分量が所定量を超えたときに失火と判定することを特徴とする。請求項５に係る発明は、前記未燃排気成分量を、吸入空気量、燃料噴射量及び機関冷却水温度のうち少なくとも１つに基づいて推定することを特徴とする。

【００１０】請求項６に係る発明は、前記吸気絞り弁及びＥＧＲ弁の開度を大きくすることにより、空気過剰率一定のまま作動ガス量を増加させることを特徴とする。

【００１１】

【発明の効果】請求項１に係る発明によれば、機関の運転状態に応じて燃焼室内の目標作動ガス量を設定し、該目標作動ガス量となるように吸気絞り弁及びＥＧＲ弁を制御するので、適正量の作動ガスを確保することができ、燃料の着火性を良好に維持することができる。

【００１２】なお、前記目標作動ガス量を増大させて設定すれば、同一の空気過剰率の下においても圧縮端温度を高めることができ、燃料の着火性を向上できる。請求項２に係る発明によれば、機関の運転状態に応じて設定された目標吸入空気量と前記目標作動ガス量とに基づき目標ＥＧＲ量を設定し、設定した目標吸入空気量と目標ＥＧＲ量に基づいて吸気絞り弁及びＥＧＲ弁を制御するので、作動ガス量を確保して燃料の着火性を向上させると共に、作動ガス量のうち不活性ガス（ＥＧＲ）量の比率が増加しすぎるのを回避して、燃焼速度が低下することも防止できる。

【００１３】これにより、燃焼安定性（着火性及び燃焼速度）を良好に確保しつつ、吸気絞り弁及びＧＲ弁を制御することができる。従って、始動直後等の冷機時において、空気過剰率を小さく設定して（低下させて）排気温度を昇温させて排気浄化触媒を活性化させる場合であっても、燃焼不安定や排気エミッションの悪化を招くことなく吸気絞り弁及びＥＧＲ弁を制御できる。

【００１４】請求項３に係る発明によれば、失火が判定されたときに前記目標作動ガス量の全体を低減補正するので、失火に対する寄与度の高い燃焼速度の低下を防止して耐失火性を向上させつつ、作動ガス量の大幅な減少を防止して着火性を良好に維持することができる請求項４に係る発明によれば、失火と相関が強い未燃排気成分量を検出又は推定し、検出又は推定した未燃排気成分量があらかじめ設定した所定値を超えたときに失火と判定するので、失火判定が容易である。

【００１５】請求項５に係る発明によれば、未燃排気成分量と吸入空気量、未燃排気成分量と燃料噴射時期及び未燃排気成分量と冷却水温度は、それぞれ一定の関係にあるので、吸入空気量、燃料噴射時期及び冷却水温度のうち少なくとも１つを検出又は計測することで容易に未燃排気成分量を推定できる。

【００１６】請求項６に係る発明によれば、吸気絞り弁及びＥＧＲ弁双方の開度を大きくすることにより、空気過剰率一定のまま作動ガス量を増加させることができる。すなわち、吸気絞り弁のみの開度を大きくするだけでは、空気過剰率は増大してしまい空気過剰率一定のまま作動ガス量を増加させることは不可能であり、ＥＧＲ弁のみを大きくするだけでは、ＥＧＲ量の増加により負圧が減少し、相対的に燃焼室内に吸入される吸入空気量が減少するので空気過剰率一定のまま作動ガス量を増加させることは不可能である。

【００１７】従って、ＥＧＲ弁の開度を大きくすることにより減少する吸入空気量分を補うように吸気絞り弁の開度も大きくすることで、空気過剰率一定のまま作動ガス量を増加させることができる。

【００１８】

【発明の実施の形態】以下、本発明の実施形態を図に基づいて説明する。図１は、過給機付ディーゼルエンジンのシステム図である。図に示すように、エンジン本体１には、コモンレール２、燃料噴射弁３及び図示しない燃料ポンプを構成要素とするコモンレール燃料噴射系が設けられており、高圧の燃料をエンジン本体１に供給する。

【００１９】過給機４のコンプレッサ４ａは吸気通路５に接続されており、駆動されて圧縮空気をエンジン本体１に供給する。過給機４のタービン４ｂは排気通路６に接続されており、エンジン本体１からの排気により回転されて前記コンプレッサ４ａを駆動する。なお、本実施形態においては、過給機４として可変容量型のものを用いており、低速域においてはタービン４ｂ側に設けられた可変ノズルを絞ってタービン効率を高め、高速域においては前記可変ノズルを開いてタービン容量を拡大させることにより、広い運転領域で高い過給効果を得ることができる。

【００２０】吸気通路５には、前記過給機４のコンプレッサ４ａの上流側に配設されたエアフローメータ１５と、吸気絞り弁７とが設けられている。吸気絞り弁７は、例えば、ステップモータを用いて開度変更が可能な電子制御式のものであり、その開度に応じてエンジン本体１に吸入される吸入空気量を制御する。

【００２１】排気通路６には、エンジン本体１と過給機のタービン４ｂとの間から分岐して吸気通路５に接続するＥＧＲ通路８と、該ＥＧＲ通路８に介装されたＥＧＲ弁９と、前記過給機４のタービン４ｂの下流側に配設された排気浄化装置１０が設けられている。前記ＥＧＲ弁９は、例えば、ステップモータを用いた電子制御式のものであり、その開度に応じて吸気側に還流する排気の量、すなわち、エンジン本体１に吸入されるＥＧＲ量を制御する。

【００２２】前記排気浄化装置１０は、担持した触媒によりエンジン本体１から排出される排気を酸化・還元反応により浄化する。コントロールユニット２０は、入力される各種センサからの検出信号に基づいて燃料噴射量Ｑｆ，噴射時期ＩＴを設定して前記燃料噴射弁３の駆動を制御すると共に、前記吸気絞り弁７及びＥＧＲ弁９の開度制御を行う。

【００２３】なお、前記各種センサとしては、エンジン回転速度Ｎｅを検出するエンジン回転センサ１１、アクセル開度を検出するアクセル開度センサ１２、エンジン

冷却水温度Ｔｗを検出する水温センサ１３、前記排気浄化装置１０の触媒温度を検出する触媒温度センサ１４、吸入空気量Ｑａを検出するエアフローメータ１５等がある。

【００２４】ところで、前記排気浄化装置１０は、その触媒（排気浄化触媒）が所定温度以上とならないと活性化せずに排気を浄化できないため、エンジン始動直後等の冷機時は触媒温度を早期に昇温させる必要がある。そこで、本実施形態では、エンジン始動直後において、空気過剰率λ（すなわち、シリンダ内に吸入される低温の新気量）を通常の暖機時に設定される空気過剰率よりも小さく設定する（低下させる）ことで、燃焼室内の温度、ひいては、排気温度の昇温を早めて触媒温度の早期活性化を図っている。

【００２５】ここで、空気過剰率λを小さく設定する（低下させる）方法としては、通常の暖機時よりも吸気絞り弁７を制御することで吸入空気量Ｑａを減少させる方法とＥＧＲ弁９を制御することでＥＧＲ量を増加させる方法がある。吸気絞り弁７のみにより空気過剰率λを小さくすると、燃焼室内の作動ガス量（吸入空気量Ｑａ＋ＥＧＲ量）が運転状態に応じた量よりも減少し、圧縮端温度が低下するので燃料の着火性が悪化してしまうといった問題を有する。

【００２６】一方、ＥＧＲ弁９のみにより空気過剰率λを小さくすると、燃焼により温度が上昇したＥＧＲ量が多くなるため圧縮端温度も上昇して着火性は維持できるものの、不活性ガスであるＥＧＲ量の割合が運転状態に応じた量よりも増大し、燃焼速度が低下してしまうといった問題を有する。従って、燃焼安定性を維持しつつ（効果的に）排気温度を昇温させるには、燃焼室内の作動ガスの量を確保すると共に、該作動ガス中のＥＧＲ量の割合（ＥＧＲ率）が大きくなりすぎないようにする必要がある。

【００２７】このため、本実施形態では、エンジン始動直後において空気過剰率λを低下させることにより排気温度を上昇させるが、空気過剰率λの低下に伴う吸入空気量Ｑａの減少（すなわち、作動ガス量の減少）による着火性の悪化を補うためにＥＧＲ量を増加させて作動ガス量を適正に確保する。その際、ＥＧＲ量の増加による燃焼速度の低下を抑制するように、吸入空気量ＱａとＥＧＲ量とをバランスさせた作動ガス量（目標作動ガス量）を設定するようにしている。

【００２８】以下、エンジン始動直後における吸気絞り弁７及びＥＧＲ弁９の制御を説明する。図２は、メイン制御ルーチンを示すフローチャートである。ステップ１（図ではＳ１と記す。以下同じ）では、エンジン回転速度Ｎｅ、燃料噴射量Ｑｆ、吸入空気量Ｑａを読み込む。

【００２９】ここで、エンジン回転速度Ｎｅ及び吸入空気量Ｑａは、それぞれエンジン回転速度センサ１１、エアフローメータ１５により検出されたものであり、燃料噴射量Ｑｆは運転状態に応じて設定されたものである。ステップ２では、読み込んだエンジン回転速度Ｎｅと燃料噴射量Ｑｆとに基づき、例えば図３に示すようなマップを参照して目標空気過剰率λｔを算出する。

【００３０】ここで、前記目標空気過剰率λｔは、通常の暖機時においてはエンジン運転状態に応じて最適な値を設定するものであるが、エンジン始動直後の冷機時のように排気温度を昇温させる場合には、該目標空気過剰率λｔとして、同一の運転状態において通常の暖機時に設定される値よりも小さい値を設定する（この結果、冷機時において空気過剰率λを低下させることになる）。

【００３１】ステップ３では、算出した目標空気過剰率λｔに基づき、例えば図４に示すようなテーブルを検索して目標作動ガス量を算出する。この目標作動ガス量は、目標空気過剰率λｔのときに燃焼安定性（着火性及び燃焼速度）を良好に確保できるようなＥＧＲ率となる作動ガス量を算出するものである。

【００３２】ここで、目標作動ガス量算出用のテーブル（図４）について図５を参照して説明する。前述したように、ＥＧＲ弁９（すなわち、ＥＧＲ量）のみを制御することで空気過剰率λを低下させる場合は、ＥＧＲ量を増加させるので吸入空気量は減少するが作動ガス量の変化は少ない（図５：実線）。

【００３３】しかし、ＥＧＲ弁９のみの制御では設定できる（低下させることができる）空気過剰率λに限界があるので、この限界以上に空気過剰率λを低下させるには吸気絞り弁７の制御も併用する必要がある。すなわち、ＥＧＲ弁９を全開としたまま、吸気絞り弁７を絞ることで空気過剰率λを低下させる必要がある（図５：破線）。この場合、ＥＧＲ弁９の制御を主として空気過剰率λを低下させると、不活性ガスであるＥＧＲの割合が増大するので、燃焼速度が遅くなる。

【００３４】一方、吸気絞り弁７（すなわち、吸入空気量Ｑａ）のみを制御することによって空気過剰率λを低下させると作動ガス量が減少してしまうため、圧縮端温度が低下して燃料の着火性が悪化する（図５：一点鎖線）。このように空気過剰率λを低下させるために吸気絞りを行うと着火性が悪化する傾向を示し、ＥＧＲを行うと燃焼速度が遅くなる傾向を有するため、特に、低温時に空気過剰率λを低下させる（すなわち、排気温度を昇温させる）場合には、吸気絞り弁７とＥＧＲ弁９の開度設定をバランスさせることで、作動ガス量及び作動ガスに占めるＥＧＲ量（比率）を適正に確保して、燃焼不安定な状態を回避する必要がある。

【００３５】図４のテーブルは、この点を考慮して設定されたものであり、空気過剰率λに応じて（ＥＧＲ率を考慮した）最適な目標作動ガス量を算出するものである。図２のフローチャートに戻って、ステップ４では未燃排気成分量を予測する。ステップ５では、予測した未燃排気成分量に基づき前記目標作動ガス量の低減補正を

実行する。

【００３６】ステップ６では、補正後の目標作動ガス量に基づき目標吸気絞り弁開度を算出する。ステップ７では、補正後の目標作動ガス量に基づき目標ＥＧＲ弁開度を算出する。ステップ８では、吸気絞り弁７及びＥＧＲ弁９の開度制御を実行する。

【００３７】具体的には、ステップ６で算出した目標吸気絞り弁開度となるように吸気絞り弁７の開度を制御し、ステップ７で算出した目標ＥＧＲ弁開度となるようにＥＧＲ弁９の開度を制御する。このようにすれば、燃焼安定性を確保しつつ、吸気絞り弁７及びＥＧＲ弁９を制御することが可能となる。

【００３８】なお、上記フローチャートでは、シリンダ内に流入するガス量を代表する値として目標作動ガス量を用いているが、該目標作動ガスに代えて目標体積効率を用いるようにしてもよい。この場合、エンジン運転状態に応じて目標体積効率を算出し、算出した目標体積効率に基づき吸気絞り弁７及びＥＧＲ弁９を制御することになる。

【００３９】次に、前記メイン制御ルーチン（図２）の各ステップで行われる制御について説明する。図６は、前記メイン制御ルーチン（図２）のステップ４で行われる未燃排気成分量の予測演算処理を示すフローチャートである。ステップ１１では、吸入空気量Ｑａ，燃料噴射量Ｑｆ、燃料噴射時期ＩＴ、エンジン冷却水温度Ｔｗを読み込む。

【００４０】ステップ１２では、未燃排気成分量を予測する。具体的には、未燃排気成分量と空気過剰率λ（∝吸入空気量Ｑａ／燃料噴射量Ｑｆ）、燃料噴射時期ＩＴ（ＡＴＤＣ）、冷却水温度Ｔｗとは、それぞれ図７～図９に示すような関係にあることが判っているので、これらのテーブルに基づく所定の演算処理を実行することで未燃排気成分量を予測する。

【００４１】図１０は、前記メイン制御ルーチン（図２）のステップ５で行われる目標作動ガス量の低減補正処理を示すフローチャートである。ステップ２１では、図２のステップ４で算出した未燃排気成分予測値を検出する。ステップ２２では、検出した未燃排気成分量予測値と所定値を比較する。

【００４２】この所定値は、例えば失火に至ったとき（又は失火直前）に、エンジンから排出される未燃成分量を示す値として設定されたものであり、あらかじめ実験等により求めたものである。前記予測値が所定値よりも大きい場合は、失火と判定してステップ２３に進み、図２のステップ３で算出した目標作動ガス量を低減補正する。

【００４３】すなわち、失火が判定された場合には、燃焼室内の燃焼速度の低下を改善する必要があるため、ＥＧＲ量を減少させる必要がある。しかし、単にＥＧＲ量のみを減少させると今度は作動ガス量が大きく減少してしまい燃料の着火性の悪化を招くことになる。従って、燃焼安定性が考慮された前記目標作動ガス量を（全体として）低減補正することで、着火性の悪化を最小限に抑えつつ、不活性ガスであるＥＧＲ量を低減させて燃焼速度の低下を改善する。

【００４４】これにより、耐失火性を向上させることができる。前記予測値が所定値以下の場合は、目標作動ガス量の補正を実行せず、そのまま本制御を終了する。なお、前記目標作動ガス量の低減補正の方法としては、前記予測値が所定値よりも大きい場合に目標作動ガス量を一律に所定量低減するようにしてもよいが、前記予測値と所定値との差が大きくなるほど低減する量を多くするようにしてもよい。このようにすれば、失火レベルに対応した制御が可能となる。

【００４５】図１１は、前記メイン制御ルーチン（図２）のステップ６及びステップ７で行われる目標吸気絞り弁７開度及びＥＧＲ弁９開度の算出を示すフローチャートである。ステップ３１では、図２のステップ２で算出した目標空気過剰率λｔ、運転状態に応じて設定された燃料噴射量Ｑｆ及び図２のステップ５で算出した（補正後の）目標作動ガス量を読み込む。

【００４６】ステップ３２では、目標吸入空気量Ｑｔを算出する。具体的には、下式に示すように、目標空気過剰率λｔに理論空燃比（１４．６）及び燃料噴射量Ｑｆを乗算して目標吸入空気量Ｑｔを算出する。目標吸入空気量Ｑｔ＝目標空気過剰率λｔ×１４．６×燃料噴射量Ｑｆステップ３３では、目標ＥＧＲ量を算出する。

【００４７】具体的には、下式に示すように、（補正後の）目標作動ガス量から前記目標吸入空気量Ｑｔを減算して目標ＥＧＲ量を算出する。目標ＥＧＲ量＝目標作動ガス量－目標吸入空気量Ｑｔステップ３４では、算出した目標吸入空気量と目標ＥＧＲ量に基づいて、例えば図１２に示すようなテーブルを検索して目標吸気絞り弁開度を算出する。

【００４８】ステップ３５では、算出した目標吸入空気量と目標ＥＧＲ量に基づいて、例えば図１３に示すようなテーブルを検索して目標ＥＧＲ弁開度を算出する。以上説明したように、始動直後の低温時において、目標空気過剰率λｔとして同一運転状態において通常の暖機時よりも小さい空気過剰率を設定することで排気温度を昇温させと共に、作動ガス量を適正に確保しつつ、吸入空気量ＱａとＥＧＲ量とのバランスを考慮して吸気絞り弁７及びＥＧＲ弁９の開度設定を行うので、燃焼安定性を確保しつつ、排気浄化触媒の早期活性化が図れる。

【００４９】なお、排気浄化触媒の活性化終了後は、上述したように目標作動ガス量を設定することなく（すなわち、目標作動ガス量にかかわらず）、例えばエンジン運転状態に基づいて目標吸入空気量Ｑｔと目標ＥＧＲ率を設定し、吸気絞り弁７とＥＧＲ弁９をそれぞれ制御するようにしてもよい。また、上記フローチャートでは、

目標空気過剰率λｔの下で吸入空気量ＱａとＥＧＲ量とがバランスされた目標作動ガス量となるように吸気絞り弁７及びＥＧＲ弁９を制御しているが、空気過剰率λを一定としたまま、燃焼室内の作動ガス量をより多く設定することもできる。

【００５０】この場合は、図４に示すマップを基に設定された吸気絞り弁７及びＥＧＲ弁９それぞれの開度に対して、吸気絞り弁７及びＥＧＲ弁の双方を更に開く方向に制御すればよい。

【図面の簡単な説明】

【図１】本発明の実施形態に係るシステム図。

【図２】同じくメイン制御ルーチンを示すフローチャート。

【図３】同じく目標空気過剰率λｔ算出用マップの１例を示す図。

【図４】同じく目標作動ガス量算出用テーブルの１例を示す図。

【図５】同じく吸気絞り弁又はＥＧＲ弁の制御に伴う空気過剰率と作動ガス量の関係を示す図。

【図６】同じく未燃排気成分量の予測演算処理ルーチンを示すフローチャート。

【図７】同じく空気過剰率λと未燃排気成分量との関係を示す図。

【図８】同じく燃料噴射時期ＩＴと未燃排気成分量との関係を示す図。

【図９】同じく冷却水温度Ｔｗと未燃排気成分量との関係を示す図。

【図１０】同じく目標作動ガス量の低減補正処理ルーチンを示すフローチャート。

【図１１】同じく目標吸気絞り弁及びＥＧＲ弁開度の演算処理ルーチンを示すフローチャート。

【図１２】同じく目標吸気絞り弁開度算出用テーブルの１例を示す図。

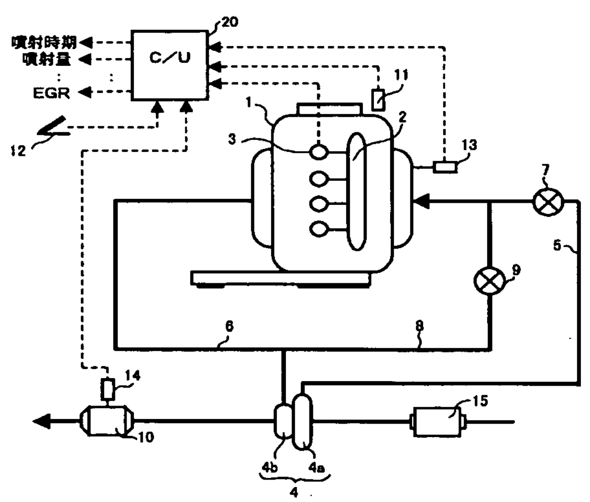
【図１３】同じく目標ＥＧＲ弁開度算出用テーブルの１例を示す図。

【図１４】作動ガス量と筒内圧力、熱発生率の関係を示す図。

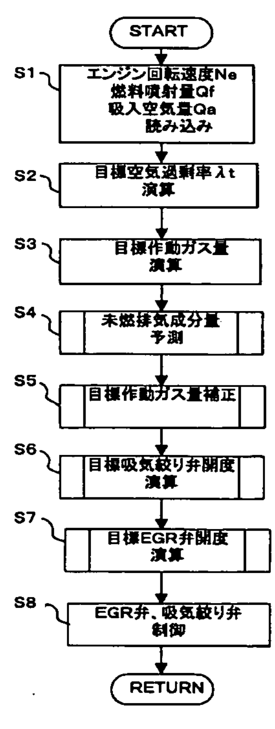
【符号の説明】

１　エンジン本体
２　コモンレール
３　燃料噴射弁
５　吸気通路
６　排気通路
７　吸気絞り弁
８　ＥＧＲ通路
９　ＥＧＲ弁
１０　排気浄化装置
２０　コントロールユニット（Ｃ／Ｕ）

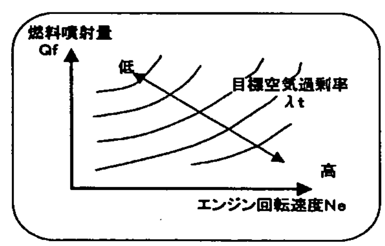
【図１】



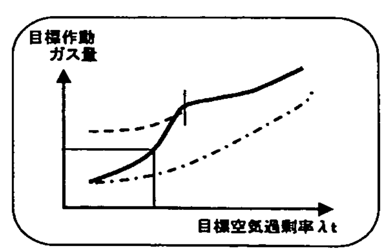
【図２】



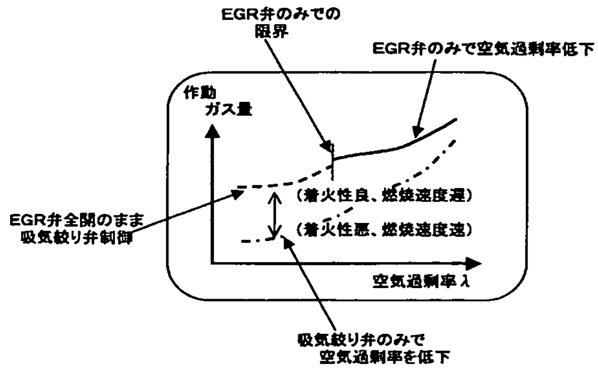
【図３】



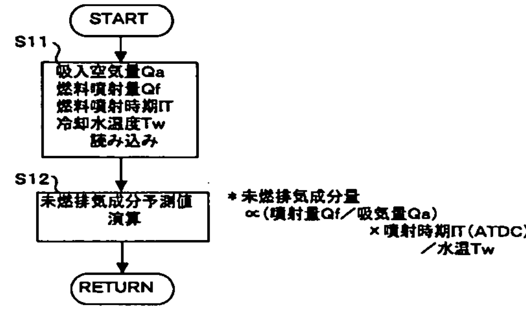
【図４】



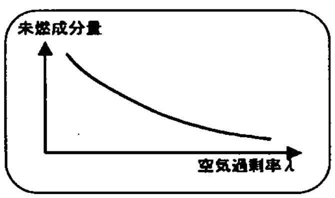
【図５】



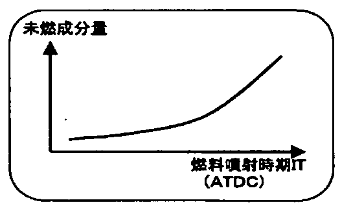
【図６】



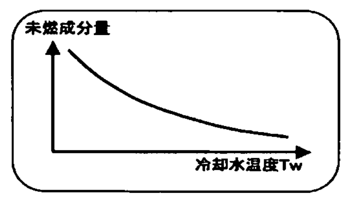
【図７】



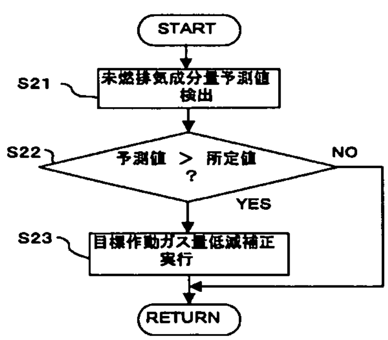
【図８】



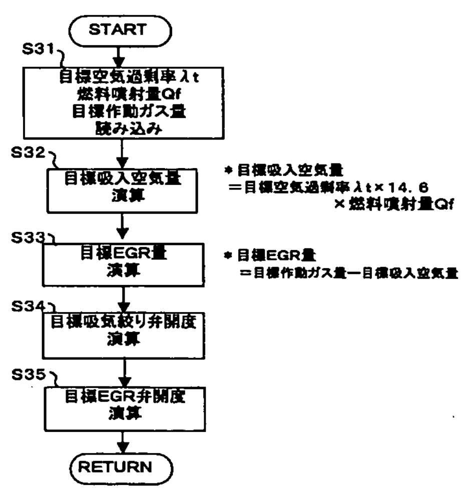
【図９】



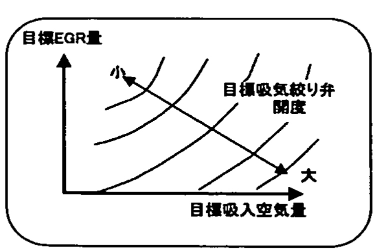
【図１０】



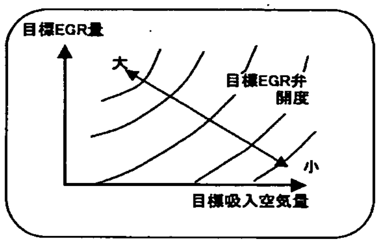
【図１１】



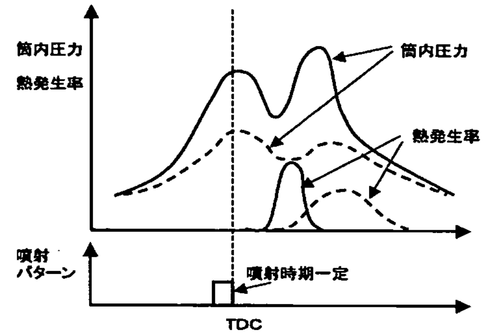
【図１２】



【図１３】



【図１４】



フロントページの続き

(51) Int.Cl.[7]		識別記号	F I		テーマコード (参考)
Ｆ０２Ｄ	45/00	３６８	Ｆ０２Ｄ	45/00	３６８Ｚ
Ｆ０２Ｍ	25/07	５５０	Ｆ０２Ｍ	25/07	５５０Ｆ
					５５０Ｒ

Ｆターム(参考) 3G062 AA01 AA03 AA05 BA04 BA05
BA06 CA06 DA01 DA02 EA11
ED01 ED04 ED10 FA02 FA05
FA06 FA13 FA23 GA01 GA04
GA06 GA08 GA09 GA15
3G065 AA01 AA03 AA04 CA00 DA06
EA07 EA10 FA12 GA05 GA08
GA09 GA10 GA12 GA18 GA46
HA06 JA04 JA09 JA11 KA02
3G084 AA01 AA03 BA05 BA08 BA13
BA20 CA03 CA04 DA28 EA04
EA11 EB08 EB12 EC01 EC03
FA07 FA10 FA13 FA17 FA20
FA27 FA33
3G092 AA02 AA06 AA13 AA17 AA18
BB01 BB06 DB03 DC03 DC08
DE03S DG08 EA01 EA02
EB05 EB09 EC09 FA15 GA03
GA16 HA01Z HB01Z HB02Z
HD02Z HE01Z HE08Z HF08Z
3G301 HA02 HA04 HA06 HA11 HA13
JA21 KA06 KA23 LA03 LB11
LC04 MA11 MA18 NA08 NB03
NB13 NC02 ND02 NE01 NE06
PA01Z PB03Z PB05Z PD12Z
PE01Z PE08Z PF03Z